throughout the motion it is necessary and sufficient that the total flux of velocity out of any closed surface shall equal the excess of the velocital volume over the sum of the volume and the hodographic volume, whatever the choice of units of length and time:

$$\oint_S d\mathbf{S}\cdot\mathbf{v} = V_V - (V_S + V_H); \quad (38)$$

in particular, for an isochoric motion the condition becomes

$$V_V = V_S + V_H . \quad (39)$$

This theorem characterizes the class of motions in which the balance between deformation and rotation holds not merely on the average over the whole motion, but identically at each point.

PALEONTOLOGY.—*Bears from the Pleistocene Cave of San Josecito, Nuevo León, Mexico.*[1] Chester Stock, California Institute of Technology.

The cavern deposit of San Josecito in southern Nuevo León, Mexico, has yielded a large assemblage of Pleistocene vertebrates of which only the birds are as yet adequately known.[2] Two types of bears have been identified recently among the fossil mammals. These represent individuals closely allied to the spectacle bears (*Tremarctos*) of South America and a member of the group of black bears (*Euarctos*) of North America.

A somewhat similar composition of the post-Pliocene ursine assemblage of Mexico was described by Freudenberg,[3] except that the tremarctine type found at Tequixquiac was identified by him as belonging to *Arctotherium simum* Cope. This is the species described by Cope and others for the Pleistocene of California and is definitely a larger type than the tremarctine bear from San Josecito Cave; it is likewise generically extinct. In addition, Freudenberg[4] describes the left jaw fragment of a black bear that he refers to the living *Ursus americanus* Pallas. The location of occurrence of this specimen, according to Freudenberg, is not known.

Thus, it appears desirable to make available at this time the new record of fossil bears at the San Josecito Cave locality, particularly since the tremarctine is identified as belonging to the Recent genus, and is the first record of the latter in Mexico.

[1] Contribution No. 553, Division of the Geological Sciences, California Institute of Technology. Received July 2, 1950.

[2] Miller, Loye, Univ. California Publ. Zool. **47** (5): 143–168. 1943.

[3] Freudenberg, W., Geol. und. Paleont. Abh. (n. f.) **9** (3): 198–205. 1910.

[4] *Op. cit.*: 204–205. 1910.

Tremarctos mexicanus, n. sp.

Type specimen.—Calif. Inst. Tech. Vert. Paleont. Coll. No. 3933, a left ramus of the mandible with P_2 to M_3 inclusive. Associated with the type is a fragment of the left maxillary with M^1 and M^2.

Paratype.—Calif. Inst. Tech. Vert. Paleont. Coll. No. 3934, a left skull fragment with P^4–M^2.

Locality and age.—San Josecito Cave, southern Nuevo León, Mexico; Calif. Inst. Tech. Vert. Paleont. Locality no. 192. Pleistocene.

Specific characters.—Larger than living species, *Tremarctos ornatus* (Cuvier), and smaller than Pleistocene bear *Arctodus floridanus* Gidley.

DISCUSSION

The most noticeable difference between the fossil and the skulls of the Recent *Tremarctos ornatus* is in character of size, the former being larger than the largest mandible available of the living spectacle bear. Expression of this difference in size between the two is shown also by the upper teeth.

In the fossil ramus, C. I. T. no. 3933, there appears to be a greater upturn of the lower rim of the mandible below the premasseteric fossa and that below the region posterior to the fossa. There is likewise a slightly greater difference in height of horizontal ramus, as measured normal to its lower border in no. 3933, than in *T. ornatus*. The crest separating the premasseteric from the masseteric fossa is curved, but its outermost part is broken away.

In the lower jaw from the Pleistocene of Nuevo León the largest mental foramen lies below and in part in front of P_3. This position is similar to that in jaws of *T. ornatus*. A foramen

of slightly smaller size is situated 11.7 mm in back of the forward opening, and lies therefore below P_4. In Recent specimens a much smaller foramen lies farther back, below the posterior half of M_1.

A longer diastema separates P_2 from P_3, and also P_3 from P_4 in the fossil than in Recent specimens. Furthermore, P_4 is relatively smaller in the fossil than in the Recent. On the whole, the characters exhibited by no. 3933 and outlined in the present comparison are to be regarded as of specific rather than of generic value.

In character of size no. 3933 is intermediate between the largest examples of the Recent *Tremarctos ornatus* in the collections of the U. S. National Museum and U.S.N.M. no. 11833, the type of *Arctodus floridanus* Gidley from the Pleistocene of Melbourne, Fla. No. 3933 from San Josecito Cave likewise agrees with *A. floridanus* in the wider spacing of the premolars, for as in the latter a longer diastema separates P_2 from P_3 and P_3 from P_4 than in *T. ornatus*. These distances are greater in *A. floridanus* than in *T. mexicanus*.

Unfortunately, the jaw is broken between the base of the canine and the posterior rim of P_2 in Gidley's type, so that no reliable measurement can be taken from the anterior end of the alveolus for P_1 to the posterior side of P_4. This distance, however, in the jaw from Nuevo León appears to be only slightly shorter in relation to the length of the lower molar series than in the species from the Florida Pleistocene. In this respect, no. 3933 is also intermediate between *A. floridanus* and *T. ornatus*. The oblique crest separating the premasseteric from the masseteric fossa reaches the anterior border of the coronoid process above the level of M_3, in which respect no. 3933 approaches *A. floridanus*, but this position is approximated in some skulls of *T. ornatus*. Though the type from Melbourne unquestionably represents a form distinct from known tremarctine bears, question may be raised with regard to its generic assignment.

Gidley[5] pointed out that "*Arctodus floridanus* is distinguished from *A. pristinus* and *A. haplodon* by its smaller size and relatively narrower molars as well as by a tendency to greater numbers of the minute tubercles of the flat triturating surfaces of the molars." The lower molars of Gidley's type are narrow transversely as in *Tremarctos* and the triturating surface of M_2 and M_3 is finely

[5] Gidley. J. W., Journ. Washington Acad. Sci. **18**: 432–433. 1928.

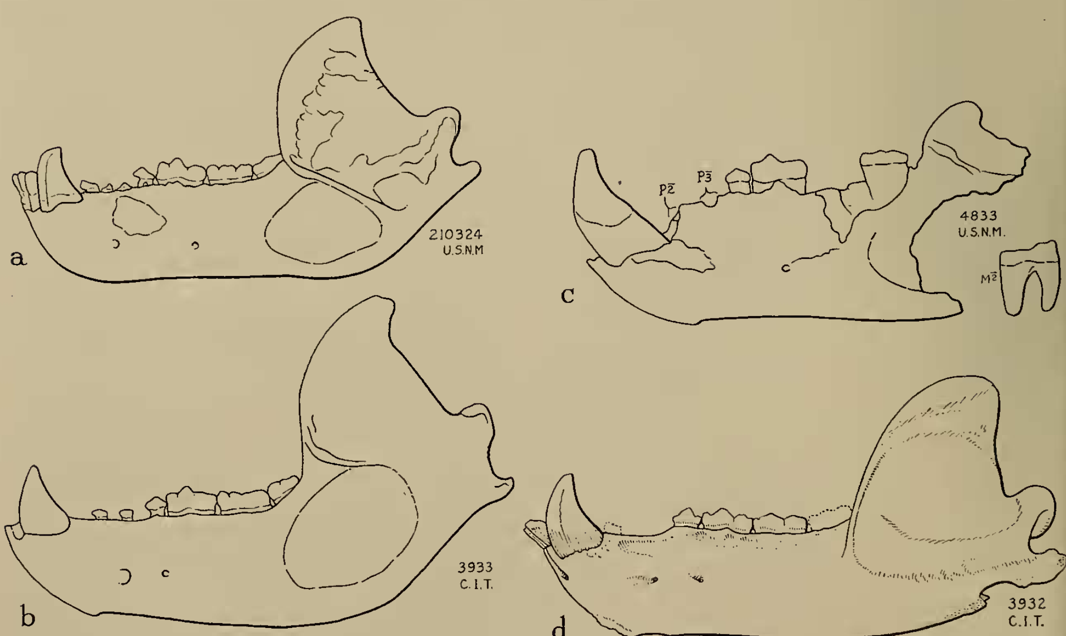

Fig. 1.—Left ramus of Recent and Pleistocene bears, lateral views, × $\frac{1}{3}$: *a*, *Tremarctos ornatus* (Cuvier), Recent, Ecuador; *b*, *T. mexicanus*, n. sp., Pleistocene, San Josecito, Nuevo León, Mexico; *c*, *Arctodus floridanus* Gidley, Pleistocene, Melbourne, Fla.; *d*, *Euarctos*, near *americanus* (Pallas), Pleistocene, San Josecito, Nuevo León, Mexico.

Table 1.—Measurements (in millimeters) of Mandibles of Tremarctos*

Measurement	CIT 3933 Pleisto-cene	AMNH 67732 Recent	AMNH 42493 Recent	USNM 210323	USNM 210324	USNM 271418	USNM 171011	USNM 194309	USNM 170656	USNM 170657	*Arctodus floridanus* Type USNM 11833
Length from anterior end of symphysis to midpoint of condyle		178.3	146.4	171.0	173.8	167.7	152.0	140.0	139.0	143.0	
Length from anterior end of symphysis to angle		173.0	140.4	178.3	180.6	176.3	158.4	144.7	144.8	148.0	
Length of tooth row, anterior end of base of C to posterior end of M_3	116.2	101.0	83.1	134.7	99.4 worn	*A* 96.2	88.8	82.9	84.7	86.7	134.7
Length, anterior end of alveolus from P_1 to posterior end of P_4	35.7	30.5	23.9	27.9	27.3	28.0	23.7	22.3	19.9	21.2	
Length from anterior end of M_1 to posterior end of M_3	56.3	51.8	44.4	51.7	54.1	50.2	47.5	45.2	49.6	48.3	62.4
Height of coronoid process above angle	97.1	83.7	68.3	80.8	85.5	79.0	71.7	63.7	69.2	68.2	
Depth of horizontal ramus at posterior end of M_3, taken normal to base of tooth row	45.6	37.8	31.7	40.4	40.3	37.8	30.9	30.4	30.1	29.5	
Depth of horizontal ramus at posterior end of P_2, taken normal to base of tooth row	38.5	34.9	29.5	35.4	38.1	35.1	29.7	26.3	27.6	27.5	*A* 44.8
C, anteroposterior diameter at base of crown	19.6	16.8	13.6	16.5	*A* 16.1	16.0	14.4	13.7	14.0	15.6	21.0
C, transverse diameter at base of crown	12.4	10.6	8.8	11.2	11.5	10.5	9.9	8.9	9.5	9.1	14.3
P_2, anteroposterior diameter	5.1	5.5	3.1	5.4		5.3	4.7	4.6	4.5	4.4	
P_2, transverse diameter	3.3	3.7	2.5	3.5		3.3	2.9	2.9	2.9	3.6	
P_3, anteroposterior diameter	4.8	5.5	3.2	4.7		5.4	4.5	4.6	4.8	5.0	
P_3, transverse diameter	3.0	4.0	2.5	3.4		3.8	2.9	3.1	3.1	3.0	
P_4, anteroposterior diameter	7.9	8.2	7.6	9.1	8.0	8.5	6.9	7.0	7.4	7.8	9.2
P_4, transverse diameter	4.6	5.9	4.5	5.6	5.6	5.6	5.0	4.7	5.3	5.4	5.6
Length of diastema between P_2 and P_3	5.4	2.0	1.4	9.1	1.9	2.0	2.0	1.3	1.2	1.2	
Length of diastema between P_3 and P_4	6.6	2.2	1.2	5.2	2.0	1.6	2.4	1.1	1.5	0.6	
M_1, anteroposterior diameter	20.0	18.9	16.4	22.3	20.0	19.2	17.5	17.3	18.7	18.0	22.4
M_1, greatest transverse diameter	9.3	9.6	7.8	11.2	10.5	9.3	8.5	8.6	8.8	9.1	11.2
M_2, anteroposterior diameter	20.8	18.4	16.8	19.2	19.9	18.0	18.3	16.9	18.3	17.2	
M_2, transverse diameter	12.1	11.7	10.0	9.8	12.1	11.5	10.8	10.0	11.4	11.0	
M_3, anteroposterior diameter	14.6	14.7	12.3	13.6	14.7	12.7	11.8	11.1	13.3	12.6	
M_3, greatest transverse diameter	11.6	10.9	9.0	11.1	12.1	11.1	10.1	8.9	10.0	10.0	

* With exception of nos. 3933 and 11833, specimens belong to living species, *Tremarctos ornatus* (Cuvier).
A, approximate.

crenulate or tuberculate as in the South American bear. The resemblance between the two extends to the location of many of the individual tubercles, which in some specimens can be identified as having the same position in both the fossil and Recent teeth. These resemblances are therefore regarded as further evidence supporting the view that the tremarctine bear from the Pleistocene of Florida is more closely related to *Tremarctos* than to *Arctodus*. Furthermore, it is the largest known species of *Tremarctos* in the former extension of range of the genus from South America into Mexico and Florida. The following additional measurements of the fossil specimens are pertinent in connection with the latter range in size:

	No. 3933 Nuevo León	*No. 4833 Florida*
M^1, anteroposterior diameter along inner side	17.3	19.3
M^1, transverse diameter across posterior third of tooth	13.8	16.1
M^2, anteroposterior diameter	27.6	31.1
M^2, transverse diameter across protoconid	14.6	16.2

In addition to the striking differences in the construction of the lower jaw in *Tremarctos* and *Euarctos*, shown by the presence in the former and absence in the latter of the premasseteric fossa, differences are likewise seen in the lower posterior portion of the ramus. The inferior border is much more curved in *Tremarctos* and sweeps directly to its posterior terminus, the angular process. In *Euarctos*, on the other hand.

Table 2.—Measurements (in millimeters) of Skulls of Tremarctos*

Measurement	CIT 3934 Pleistocene	AMNH 67732 Recent	AMNH 42493 Recent	CIT 3933 Pleistocene	USNM 210323 Recent	USNM 210324 Recent	USNM 271418 Recent	USNM 171011 Recent	USNM 194309 Recent	USNM 170656 Recent	USNM 170657 Recent
Length of tooth row, C to posterior end of M^2	110.0	89.5	75.0		88.4	88.8	*A*88.8	80.7	72.9	72.1	78.8
Length from anterior end of alveolus of P^1 to posterior end of M^2	84.1	69.7	59.0		67.9	69.1	*A*66.9	62.6	56.9	57.8	61.0
Length from anterior end of M^1 to posterior end of M^2	46.6	41.6	35.7		41.0	42.7	41.9	38.0	35.1	36.3	38.1
C, anteroposterior diameter at base of crown	19.5	*A*17.5			17.3	18.5	*A*19.3	16.0	14.1	15.2	15.3
C, transverse diameter at base of crown	12.1	11.2			12.0	12.0		10.2	8.7	9.6	8.9
P^1, anteroposterior diameter		6.9	5.3		6.1	6.9	5.6	5.8	5.6	5.2	6.1
P^1, transverse diameter		4.3	3.8		4.1	4.5	4.4	4.0	3.8	3.7	3.9
P^2, anteroposterior diameter of crown		5.1	5.0		4.8	5.7	4.1	4.8	4.6	4.5	4.4
P^2, transverse diameter of crown		3.2	3.2		3.4	3.4	3.3	2.8	3.0	2.3	2.9
P^3, anteroposterior diameter of crown		4.3	3.7		6.5	5.4	5.3	4.9	4.9	5.1	4.9
P^3, transverse diameter of crown		3.4	2.6		3.8	3.4	3.4	3.0	3.1	3.3	2.9
P^4, anteroposterior diameter along outer side	14.2	13.7	11.0		12.7	13.5	12.3	11.2	11.3	11.9	11.2
P^4, transverse diameter across protocone	11.4	9.6	7.0		9.8	9.6	9.1	8.1	8.2	8.4	8.2
M^1, anteroposterior diameter	18.2	16.7	14.8	*A*17.5	17.3	18.1	16.9	15.7	15.9	16.1	15.5
M^1, greatest transverse diameter	14.5	12.8	11.2	*A*13.6	13.6	14.7	14.0	11.6	12.5	11.9	11.7
M^2, greatest anteroposterior diameter	28.9	24.3	20.9	27.9	23.7	25.6	24.7	22.2	21.0	20.9	22.2
M^2, greatest transverse diameter	14.8	13.8	11.9	14.5	13.7	14.5	14.2	12.9	12.5	12.6	12.8
Length from anterior end of premaxillary to middle of rim of postnarial notch					115.4	117.9	108.7	104.7	91.0	89.9	98.3

* With exception of no. 3934, specimens belong to Recent species, *Tremarctos ornatus* (Cuvier).
A, approximate.

the inferior border ends well in front of the angle, and a break in the form of a notch on the lower contour of the jaw separates it from the angular process. The latter is much more prominent in *Euarctos* than in *Tremarctos* (compare Fig. 1, *a* and *d*).

In the jaw of the tremarctine bear the vertical distance between angle and condyle, as seen from the rear, is distinctly greater. In the Recent *Tremarctos* a rudimentary process may sometimes occur on the inferior border of the ramus below the true angle, but in no. 3933, as in many existing specimens, the border swings smoothly upward along the inside of the thickened ventral surface. The absence of a projection at the posterior end of the ventral border of the ramus in *Tremarctos* and its distinctness from the angle furnish additional striking differences between this genus and *Euarctos*.

Euarctos, near americanus (Pallas)

The North American black-bear group is represented in the collection by a left ramus of the mandible, Calif. Inst. Tech. Vert. Paleont. Coll. no. 3932. Comparing the specimen with jaws of the living black bear brings out the fact that the essential difference between them relates to the larger size of the molar teeth in the fossil. Other than this character, and increased size of lower canine, resemblance prevails between the available materials of the Pleistocene and Recent bears.

Table 3.—Measurements (in millimeters) of C.I.T. No. 3932

Length, anterior end of symphysis to posterior end of angle	201.0
Length, anterior end of symphysis to posterior end of middle of condyle	193.9
Height of coronoid process above angle	85.5
Length, anterior end of base of C to posterior end of M_2	100.2
Length, anterior end of P_4 to posterior end of M_2	51.0
Depth of jaw at posterior end of M_2	41.6
P_4, anteroposterior diameter	10.4
P_4, transverse diameter	5.7
M_1, anteroposterior diameter	19.3
M_1, greatest transverse diameter	9.7
M_2, anteroposterior diameter	21.7
M_2, greatest transverse diameter	13.1

Schultz,[6] in describing the species *Ursus optimus* from the Pleistocene asphalt deposits of McKittrick, Calif., called attention to the relatively larger molar dentition which distinguished this Pleistocene form. It should be indicated that the canine is likewise of larger size in the bear from McKittrick than in the modern species.

The scarcity of remains of black bears does not permit a demonstration of the extent of variation in size of the form from the Pleistocene. The jaw from San Josecito Cave is smaller than that of *U. optimus*, but like the latter it shows an increase in size of the molars, although this increase is not so great as in the Californian individual. It seems possible that the Mexican bear is a member of the group typified by the McKittrick specimen and characterized by greater range in size than is found to be true of *Euarctos americanus* today.

[6] Schultz, J. R., Carnegie Inst. Washington Publ. 487: 178–181, pl. 11. 1938.

PALEOBOTANY.—*An Oligocene evergreen cherry from Oregon.*[1] Roland W. Brown, U. S. Geological Survey.

At Holley, Linn County, Oreg., marine fossils from rock outcrops indicate the relative position of the easternmost shoreline of the Oligocene sea. North and east of Holley, particularly in the vicinity of Sweet Home, nonmarine exposures in railroad cuts, highway cuts, and ravines, contain beautifully preserved leaves, fruits, seeds, and wood of land plants. Locally the wood is very abundant, the dominant species apparently being a kind of sycamore (*Platanus*). From a locality 12 miles east of Holley, L. W. Staples (*4*), of the University of Oregon, described some of this wood, which has the unusual feature of containing cubic pseudomorphs of quartz after halite. Staples interpreted these crystals as meaning that the lowlands where the sycamores grew were inundated by the advance of an arm of the sea, thus killing the trees. Salt solutions then permeated the dead trunks and at appropriate foci halite crystals developed, pushing the wood cells aside. Eventually, alluvial materials and volcanic ash buried the trees, ended the saline phase, and inaugurated the freshwater percolation conditions for dissolving the halite crystals and for the concentration of silica in their place.

My introduction to this geologic situation occurred during August 1949, when, in company with Dr. H. E. Vokes and Don Myers, of Johns Hopkins University, I made collections of the fossil flora at a number of localities near Sweet Home. Subsequent study of these collections shows that the flora includes species of sequoia, hydrangea, laurel, sycamore, sweetgum, katsura, and cherry. Although the cherry may not be the only new species in this flora, it is singled out for attention here because its remains are particularly well preserved, showing distinctive, identifying features.

Numerous fossil leaves and seeds have been assigned to the genus *Prunus*, which includes the cherries and plums. Of all these, only a handful, perhaps 20 or 30, may be considered authentic. Most of the species are leaf-species, and of these, only two—*Prunus aucubaefolia* Massalongo (*2*, p. 415, pl. 28, fig. 2), from Miocene strata near Senigallia on the east coast of Italy, and *P. laurocerasus pliocenica* Laurent (*1*, p. 179, pl. 14, fig. 4), from the Pliocene of the Department of Cantal, France—appear to be assignable to the evergreen section of the racemed species of *Prunus*. Neither of these shows any glands. Consequently, so far as I know, the present specimens from Oregon are the first known fossils of the evergreen group showing glands within the blades of the leaves.

The leaves of deciduous and evergreen cherries are somewhat comparable in at least two features—venation and marginal dentition. The evergreen species, however, tend to be tougher in texture, and less toothed or entire, the teeth, as a rule, being coarser and sharper. The two groups differ markedly in another respect—the presence and position of prominent glands. In most of the deciduous cherries one or more conspicuous glands are present on the petiole, near its top. In

[1] Published by permission of the Director, U. S. Geological Survey. Received July 2, 1950.